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AN ANALYSIS OF *PEROMYSCUS DIFFICILIS* FROM THE MEXICAN-UNITED STATES BOUNDARY AREA

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In April of 1964 and 1969 Woodrow W. Goodpaster, collecting for the Museum of Natural History, University of Illinois, obtained 15 specimens of *Peromyscus* of uncertain taxonomic status from the Franklin Mountains, El Paso County, Texas. Numerous mammalogists examined these 15 specimens, offered suggestions for possible affinities, but never were certain enough to assign specific identification. Subsequent examination of these and additional specimens, some of which were from the Franklin Mountains, proves that they are *Peromyscus difficilis*, that this species occurs in mountainous areas near the Rio Grande River, and that they are referable to a distinct subspecies. This subspecies is called *Peromyscus difficilis penicillatus* Mearns (*Peromyscus boylii penicillatus* of Mearns).

To establish a means of species recognition, comparative studies using 20 skin and skull features were made of samples of *P. polius*, *P. boylii rowleyi*, *P. pectoralis laceianus*, *P. truei truei*, *P. truei comanche*, *P. attwateri*, and *P. difficilis*. In addition cranial and external morphology, along with cytological evidence was used in studying intrapopulation and interpopulation variation in five subspecies of *P. difficilis*: *P. d. nasutus*, *P. d. griseus*, *P. d. penicillatus*, *P. d. difficilis*, and *P. d. petricola*.

Methods

Over 1000 specimens representing six species of the genus *Peromyscus* were studied. External measurements were taken

from the specimen label and 15 cranial measurements were taken by me with a dial caliper and recorded in millimeters. Head and body length was calculated. The 15 cranial measurements were: greatest skull length, basilar length, breadth of braincase, mastoid breadth (distance between lateral expansions of mastoid processes), zygomatic breadth (greatest distance between the outer borders of the zygomatic arches), bullae breadth (least distance between the ventral margins of the bony external auditory meatuses), bulla length (least distance from the antero-ventral margin of the bony external auditory meatus to the point of exit of the eustachian tube from the bony auditory bulla), least interorbital constriction, nasal length, palatal length, palatal foramen length, diastema length, post-palatal length, maxillary toothrow length (actual length of the molar toothrow measured near the crown of the teeth), and skull depth (taken as described by Hooper, 1952:10). All other measurements were taken as illustrated by Hoffmeister (1951:28).

Ageing of specimens was based on wear of the upper molar toothrow. Ageing is discussed in "Nongeographic Variation."

Species Recognition

Specimens of *P. d. penicillatus* from the Franklin Mountains, El Paso County, Texas, are like specimens of other subspecies of *P. difficilis* in having a tail usually longer than the head and body, large hind feet, ears of moderate length, a broad braincase, long maxillary toothrow, and moderately inflated auditory bullae.

P. difficilis penicillatus differs in coloration from *P. boylii rowleyi* in having uniform pale gray upper parts with the sides and top of the head a noticeable lighter gray than the gray body, rather than ochraceous sides and brownish upper parts and head; externally in a longer tail, hind feet, and ears; cranially in a broader braincase, greater mastoidal breadth, more inflated auditory bullae, and shorter nasals; chromosomally four pairs of large biarmed autosomes rather than one pair of large biarmed autosomes. See Figure 1 for comparisons of maxillary toothrow length vs. bullae breadth.

P. d. penicillatus differs from *P. pectoralis laceianus* ex-

ternally in having a longer tail, hind feet, and ears; cranially in a broader braincase, greater mastoidal breadth, more inflated auditory bullae, longer maxillary toothrow, and greater skull depth. See Figure 1 for comparisons of maxillary toothrow length vs. bullae breadth.

P. d. penicillatus differs from *P. attwateri* externally in having a shorter head and body and shorter hind feet; cranially in a shorter skull, smaller zygomatic breadth, smaller interorbital constriction, shorter nasals, and shorter diastema; chromosomally four pairs of large biarmed autosomes rather than three pairs of large biarmed autosomes.

P. d. penicillatus differs from *P. truei truei* and *P. truei comanche* externally in having a longer tail (much shorter in *P. t. truei* and slightly shorter in *P. t. comanche*), and shorter ears; cranially in less inflated auditory bullae, longer palate, and longer maxillary toothrow; chromosomally four pairs of large biarmed autosomes rather than five pairs of large biarmed autosomes. See Figure 1 for comparisons of maxillary toothrow length vs. bullae breadth. *P. t. comanche*, considered a distinct species by Johnson and Packard (1974), is here considered a subspecies of *P. truei* following Schmidly (1973a).

P. d. penicillatus differs from *P. polius* externally in having a shorter head and body, and shorter hind feet; cranially in a shorter skull, narrower braincase, smaller mastoidal breadth, smaller zygomatic breadth, shorter nasal, shorter diastema, and shorter maxillary toothrow.

Habitat

During the progress of this study, specimens of *P. difficilis* were taken by me at 14 different localities representing 10 counties in Arizona, New Mexico, Oklahoma, and Texas. Specimens were taken as low as 4700 ft, Franklin Mountains, Texas, and as high as 8200 ft, Chiricahua Mountains, Arizona.

The parameter in common to all areas where *P. difficilis* was collected was the "rockiness" of the habitat. Adult individuals were invariably taken in rocky situations such as lava beds, talus slopes, areas of numerous jumbled rocks, or

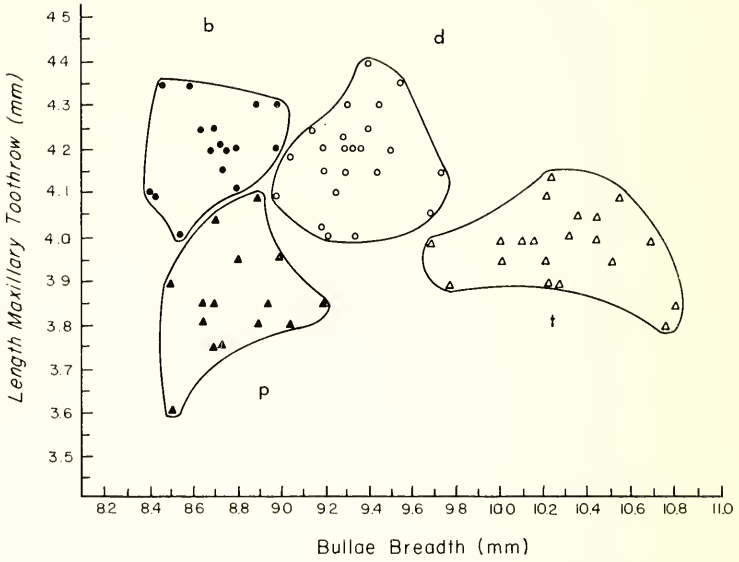

Fig. 1. Individual specimens of four species of *Peromyscus* plotted according to bullae breadth vs. maxillary toothrow length, on a scatter diagram. *P. b. rowleyi* (indicated by solid circles on the scattergram), Franklin Mtns., Texas; *P. d. penicillatus*, Franklin Mtns., Texas, open circles; *P. p. lacianus*, vic. Carlsbad, Eddy County, New Mexico, closed triangles; *P. t. truei*, vic. Winslow, Navajo County, Arizona, open triangles.

any other extensively rocky area having many fissures. Specimens taken outside such areas were usually immature individuals, probably driven into submarginal habitat by population pressure. In these rocky areas where *P. difficilis* was abundant, *P. boylii* was absent. *P. boylii* was abundant in adjacent areas of lesser rock density, and therefore more vegetated. It then seems that niche segregation of these two species is largely determined by the density of the rocks and the amount of interspace within those rocks.

Nongeographic Variation

Age variation: Analyses were done only on those individuals in adult pelage which had considerable wear on all

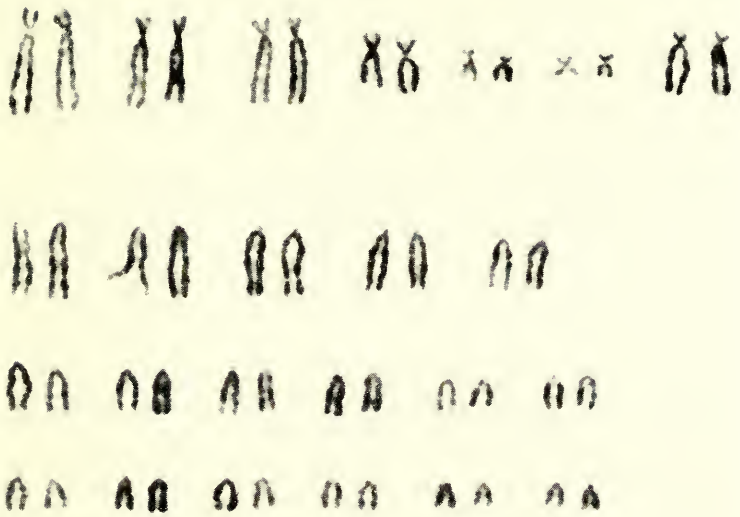

Fig. 2. Karyogram of *P. difficilis penicillatus*, female, UI 50529, from McKelligan Canyon, Franklin Mountains, El Paso County, Texas.

lingual cusps of all upper molars with at least moderate wear on all labial cusps.

Individual variation: Coefficients of variation for 20 skin and skull characters taken from a sample of 35 adult specimens from the Franklin Mountains, El Paso County, Texas, indicate, that all characters exhibited normal variability (Table 1). External measurements were more variable than cranial measurements. Individual variation of the Franklin Mountains population of *P. difficilis* was in agreement with reported variation in other species of *Peromyscus* (Hoffmeister, 1951, Schmidly, 1972, 1973b).

Secondary sexual variation: Of the 20 characters given in Table 1, ear length was sexually dimorphic at the .05 level; greatest skull length, and basilar length were sexually dimorphic at the .02 level; mastoidal breadth, and post-palatal length were sexually dimorphic at the .01 level. The 15 other characters were not significantly sexually dimorphic. Males

TABLE 1. Secondary sexual dimorphism and individual variation in *P. difficilis penicillatus* from the Franklin Mountains, El Paso County, Texas. (* denotes significant difference.)

	Females				Males				
	N	$\bar{X}$	S.D.	C.V.	N	$\bar{X}$	S.D.	C.V.	t-test
Total length	15	206.73	7.13	3.45	20	205.05	9.99	4.88	0.55
Tail length	15	112.27	4.80	4.28	20	111.50	8.22	7.37	0.32
Body length	15	94.47	4.37	4.63	20	93.55	2.63	2.81	0.77
Hind foot length	15	23.60	0.91	3.86	20	23.80	0.62	2.61	0.77
Ear length	14	20.57	0.65	3.16	20	20.00	0.73	3.65	2.34*
Greatest skull length	15	27.99	0.58	2.07	19	27.53	0.50	1.82	2.48*
Basilar length	15	21.14	0.50	2.37	19	20.74	0.41	1.98	2.56*
Breadth of braincase	15	12.91	0.24	1.86	20	12.81	0.25	1.95	1.19
Mastoidal breadth	15	12.18	0.21	1.72	19	11.98	0.14	1.17	3.33*
Zygomatic breadth	15	13.79	0.38	2.76	19	13.62	0.18	1.32	1.73
Bullae breadth	15	9.32	0.19	2.04	18	9.26	0.20	2.16	0.88
Bulla length	15	3.54	0.13	3.67	19	3.48	0.13	3.74	1.34
Interorbital constriction	15	4.41	0.12	2.72	20	4.45	0.10	2.25	1.08
Nasal length	15	10.48	0.26	2.48	20	10.32	0.30	2.91	1.65
Palatal length	15	4.37	0.18	4.12	20	4.37	0.18	4.12	0.01
Palatal foramen length	15	5.78	0.23	3.98	20	5.66	0.16	2.83	1.82
Diastema length	15	7.03	0.20	2.84	20	6.90	0.21	3.04	1.85
Post-palatal length	15	9.83	0.27	2.75	19	9.61	0.16	1.66	2.96*
Maxillary toothrow length	15	4.17	0.12	2.88	20	4.14	0.09	2.17	0.85
Skull depth	15	10.03	0.23	2.29	18	10.11	0.27	2.67	0.82

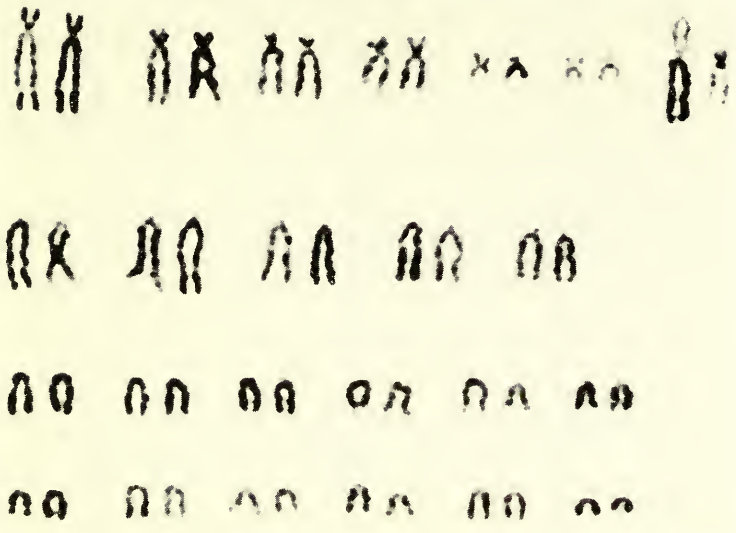

Fig. 3. Karyogram of *P. difficilis griseus*, male, UI 48397, from the Carrizozo lava beds, Lincoln County, New Mexico.

and females of a sample were combined in analyzing geographic variation.

Geographic Variation

Chromosomal evidence: Species of the genus *Peromyscus* are consistent in having karyotypes of 48 chromosomes. The autosomal complement usually consists of several pairs of large biarmed chromosomes, several pairs of small biarmed chromosomes, and a number of acrocentric chromosomes.

Hsu and Arrighi (1968) described the karyotype of *P. difficilis* as being polymorphic. Karyotypes of *P. d. nasutus* from Fort Collins, Colorado, contained four pairs of large biarmed autosomes and specimens of *P. d. saxicola* from Jacala, Hidalgo, Mexico, contained three pairs of large biarmed autosomes. Lee, et al. (1972) also described karyotypes of *P. d. nasutus* from Colorado and northwestern New Mexico with four pairs of large biarmed autosomes.

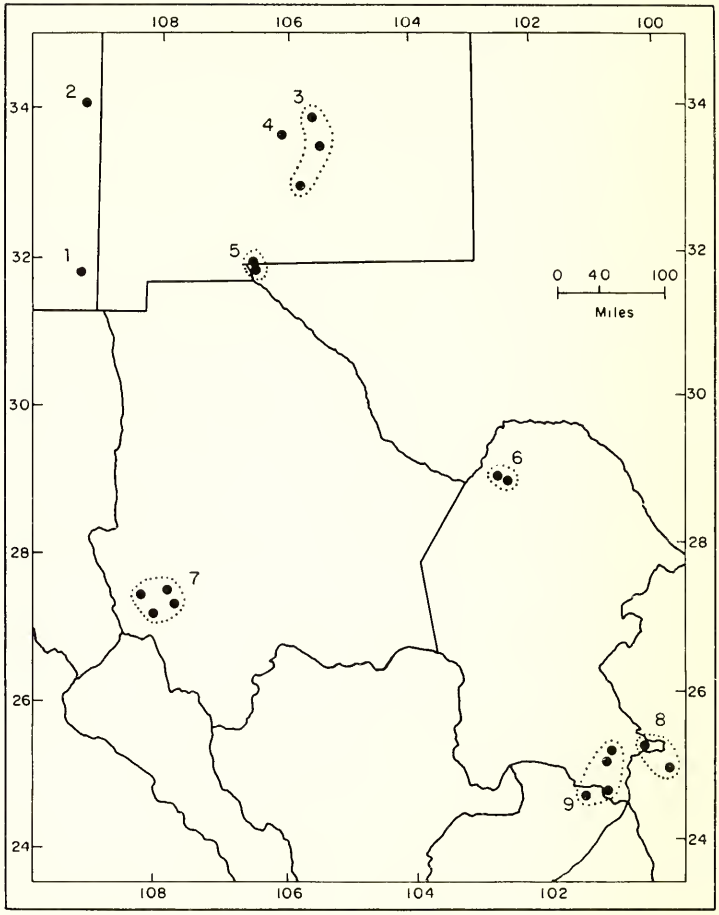

Fig. 4. Collecting localities of *P. difficilis* are represented by circles. Adjacent localities were usually grouped to increase sample size. Sample locality 1, Chiricahua Mountains, Arizona; 2, Springerville, Arizona; 3, Capitan, Jicarilla, and Sacramento mountains, New Mexico; 4, Carrizozo lava beds, Lincoln County, New Mexico; 5, Franklin Mountains, El Paso County, Texas; 6, Sierra del Carmen Mountains, Coahuila, Mexico; 7, vicinity Creel, Chihuahua, Mexico; 8, vicinity Sierra Guadalupe, Coahuila, and Cerra Potosi, Nuevo Leon, Mexico; 9, vicinity Bella Union, Carneros, Sierra Encarnacion, Coahuila; and Concepcion del Oro, Zacatecas.

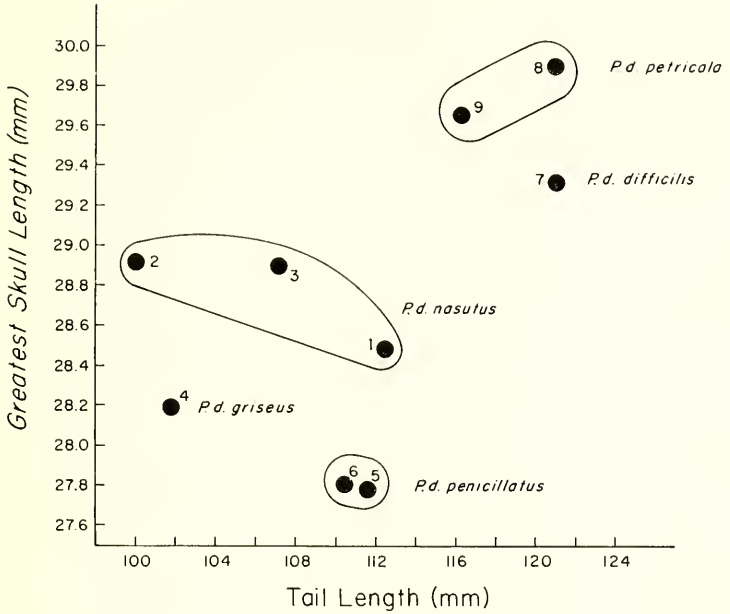

FIG. 5. Scattergram plotting mean tail length versus mean skull length in samples of *P. difficilis*. Numbers within the figure correspond to the locality numbers of Fig. 4 and Table 2.

Specimens representing two subspecies of *P. difficilis* were collected and karyotyped: *P. d. penicillatus* (Fig. 2) from the Franklin Mountains, El Paso County, Texas, and *P. d. griseus* (Fig. 3) from the lava beds near Carrizozo, Lincoln County, New Mexico. Karyotypes of both subspecies did not differ from karyotypes of *P. d. nasutus* in having four pairs of large biarmed autosomes. A series of karytoypes from both subspecies may establish slight morphological differences in the X chromosomes.

Morphological evidence: Eleven characters were selected and geographic variation was assessed to ascertain the affinities of each population to the Franklin Mountains' population of *P. difficilis*. In plotting collecting localities (Fig. 4) some localities of close proximity were grouped to increase sample size.

TABLE 2. Measurements of 9 samples of *P. difficilis*. Given for each character are: mean, 1 standard deviation each side of the mean, coefficient of variation, and sample size, respectively. Locality numbers, given in parentheses, correspond to locality numbers of Figure 4.

Head and body	Tail	Hind foot	Ear	Greatest l. skull	Breadth braincase	Mastoidal breadth	Bullae breadth	Nasal length	Diastema length	Toothrow length
(1) *P. d. nasutus*, Chiricahua Mountains, Cochise Co., Arizona										
97.2	112.5	23.91	21.74	28.44	13.22	12.34	8.84	10.71	7.43	4.35
4.49	7.24	0.54	1.30	0.79	0.22	0.22	0.25	0.37	0.36	0.10
4.62	6.44	2.26	5.98	2.78	1.66	1.78	2.83	3.45	4.85	2.30
17	16	17	17	17	17	17	17	17	17	17
(2) *P. d. nasutus*, vic. Springerville, Apache Co., Arizona										
100.3	100.0	23.42	21.96	28.91	13.24	12.31	9.47	11.37	7.50	4.26
3.69	4.19	0.76	0.91	0.47	0.20	0.20	0.17	0.31	0.19	0.12
3.68	4.19	3.26	4.16	1.61	1.52	1.63	1.81	2.70	2.53	2.74
12	11	12	12	14	14	14	13	14	14	14
(3) *P. d. nasutus*, Capitan, Sacramento, and Jicarilla mountains, New Mexico										
99.7	107.5	22.86	22.29	28.89	13.16	12.45	9.35	11.23	7.39	4.11
5.52	5.09	0.78	1.60	0.43	0.25	0.21	0.30	0.36	0.22	0.15
5.54	4.73	3.41	7.18	1.49	1.90	1.69	3.21	3.21	2.98	4.87
20	21	21	7	19	20	19	19	20	18	20
(4) *P. d. griseus*, Carrizozo lava beds, Lincoln Co., New Mexico										
94.6	101.9	23.07	21.34	28.19	12.91	12.18	9.30	11.12	7.25	4.16
3.93	5.13	0.69	1.12	0.50	0.26	0.24	0.27	0.30	0.24	0.09
4.15	5.03	2.55	5.25	1.78	1.98	1.97	2.88	2.71	3.27	2.11
44	44	44	44	43	44	44	42	43	44	44
(5) *P. d. penicillatus*, Franklin Mountains, Texas and New Mexico										
94.2	111.7	23.76	20.24	27.74	12.85	12.07	9.30	10.40	6.96	4.16
3.28	6.97	0.70	0.74	0.59	0.25	0.20	0.19	0.29	0.22	0.11
3.48	6.24	2.94	3.66	2.11	1.91	1.69	2.01	2.74	3.13	2.57
34	34	34	34	33	34	33	32	34	34	34
(6) *P. d. penicillatus*, Sierra del Carmen, Coahuila										
91.0	110.5	22.42	21.33	27.80	12.96	11.90	8.92	10.76	7.18	4.20
10.9	7.98	0.28		0.52	0.24	0.16	0.17	0.26	0.17	0.10
12.0	7.23	2.37		1.87	1.81	1.38	1.91	2.56	2.42	2.38
12	12	12	3	8	9	8	8	12	12	12

Table 2. (cont.)

Head and body	Tail	Hind foot	Ear	Greatest l. skull	Breadth braincase	Mastoidal breadth	Bullae breadth	Nasal length	Diastema length	Toothrow length
(7) *P. d. difficilis*, vic. Creel, Chihuahua, Mexico										
97.6	121.1	25.00	26.03	29.30	13.28	12.47	9.22	11.70	7.60	4.36
5.79	8.29	0.96	1.94	0.42	0.23	0.20	0.24	0.33	0.22	0.11
5.93	6.85	3.82	7.45	1.43	1.75	1.61	2.63	2.80	2.87	2.61
19	19	19	19	20	19	19	19	20	20	18
(8) *P. d. petricola*, vic. Sierra Guadalupe, Coah., Cerra Potosi, Nuevo Leon										
104.9	121.0	24.71	23.17	29.89	13.40	12.98	9.70	11.63	7.42	4.45
8.32	7.03	1.07	1.60	0.49	0.20	0.19	0.25	0.22	0.17	0.17
7.93	5.81	4.33	6.91	1.64	1.49	1.46	2.58	2.32	2.29	3.82
14	14	14	6	12	13	13	11	12	14	14
(9) *P. d. petricola*, Concepcion del Oro, Zac., vic. Sierra Encarnacion, Coah.										
103.8	116.3	24.76	22.13	29.65	13.32	12.86	9.72	11.66	7.63	4.50
7.50	10.55	0.81	0.64	0.50	0.24	0.25	0.24	0.23	0.14	0.20
7.22	9.07	3.27	2.89	1.69	1.80	1.94	2.47	1.97	1.83	4.44
17	17	17	8	16	17	16	16	17	17	17

Variation was not uniform, with areas of differentiation corresponding to large desert basins or areas of low relief. See Table 2 for measurements of all samples of *P. difficilis*. Samples from the Chiricahua Mountains, Arizona (sample 1 of Figs. 4, 5, and Table 2); Springerville, Arizona (sample 2); and from the Capitan, Sacramento, and Jicarilla mountains, New Mexico (pooled as sample 3); agree with each other and differ from the Franklin Mountains' population of *P. difficilis* in having an overall larger skull, broader braincase, greater mastoidal breadth, longer diastema, and in being darker in coloration. The Chiricahua Mountains' population of *P. difficilis* are unique as a sample in having a longer tail in combination with smaller auditory bullae but are here referred with Springerville and Capitan samples.

Sample 4 from the Carrizozo lava beds, Lincoln County, New Mexico, differ from the Franklin Mountains' population

of *P. difficilis* in having a shorter tail, longer ears, a longer diastema, longer nasals, and in being much darker in coloration.

Sample 7 from the vicinity of Creel, Chihuahua, Mexico, differs from the Franklin Mountains population in having a longer tail, longer hind feet, and much longer ears, an overall larger skull, actually smaller auditory bullae, and in being darker in coloration.

Samples 8 and 9 from northern Zacatecas, southern Coahuila, and west-central Nuevo Leon, Mexico, differ from the Franklin Mountains' population of *P. difficilis* in having a longer tail, longer hind feet, longer ears, a much larger skull with especially larger mastoidal breadth, greatly inflated auditory bullae, and in being darker in coloration.

Sample 6 from the Sierra del Carmen Mountains, Coahuila, are here referred to the subspecies *P. d. penicillatus.* Only a small sample is available, but the specimens at hand compare with the Franklin Mountains' population in coloration, all external measurements, and in all cranial measurements, except the specimens from the Sierra del Carmen Mountains have the diastema averaging slightly longer and noticeably smaller auditory bullae than the Franklin Mountains' population of *P. d. penicillatus.*

Peromyscus difficilis penicillatus Mearns

Peromyscus boylii penicillatus E. A. Mearns, 1896, Preliminary diagnoses of new mammals from the Mexican border of the United States, p. 2, May 25 (preprint of Proc. U. S. Nat. Mus., 19:139, December 21, 1896).

Peromyscus boylii rowleyi, W. H. Osgood, 1909, A revision of the mice of the American genus *Peromyscus.* N. Amer. Fauna, 28:145, April 17.

Type locality: Foothills of the Franklin Mountains, near El Paso, El Paso County, Texas. Type, skin and skull, USNM 20034/35426. Holotype examined.

Range: Known from the Franklin Mountains (extending from El County, New Mexico), Sierra del Carmen Mountains, northern Coahuila, Mexico, and a single specimen, cat. no. 21129/37194, U. S. Nat. Mus., collected by E. A. Mearns from Dog Springs, Grant County (now Hidalgo County), New Mexico. Other populations might exist on other isolated mountain ranges in northern Coahuila, western

Texas, southern New Mexico, and northwestern Chihuahua. Collecting at Dog Springs in the summer of 1974 produced only *Peromyscus boylii* and *Peromyscus eremicus.*

Diagnosis: A subspecies of *P. difficilis* recognized externally by its uniform gray upper parts, white underparts, and long penicillate tail. Paso, El Paso County, Texas, north for 10 miles into Doña Ana The sides and top of the head is noticeably lighter gray than the gray body. Cranially the smallest subspecies of *P. difficilis* with short nasals and short diastema. Karyotype of four pairs of large biarmed, two pairs of small biarmed, and 17 pairs of acrocentric autosomes.

Comparisons: *Peromyscus difficilis penicillatus* differs from *P. difficilis griseus*, *P. d. nasutus*, *P. d. difficilis*, and *P. d. petricola*, in having an exceedingly short skull (reflected in having shorter nasals and shorter post-palatal length), and in its light gray head and body coloration rather than a brown to brownish-black coloration. It differs from *P. d. nasutus* and *P. d. griseus* in having a relatively long tail (119% head and body length rather than 98 to 109%), and differs from *P. d. petricola* in having shorter ears, smaller auditory bullae, and smaller mastoidal breadth. See Figure 5 for comparisons.

Remarks: Osgood (1909:145) in synonymizing *P. d. penicillatus* (then *P. boylii penicillatus*) with *P. boylii rowleyi* says that "the type of *penicillatus* is an abnormally pale individual, but a series from the Franklin Mountains near the type locality does not differ from typical *rowleyi.*" In actuality the type of *P. boylii penicillatus* that Osgood examined was a specimen of *P. difficilis* and the series that he talks about were *P. boylii*, which also occur in the Franklin Mountains, and which are referable to *P. b. rowleyi.*

Specimens examined: Total 175 from: TEXAS. El Paso Co.: 3½ mi W Fort Bliss, Trans-Mountain Road, 5 (UI); McKelligan Canyon Park, 107 (UI); Head McKelligan Canyon, 4700 ft, 10 (KU). NEW MEXICO. Doña Ana Co.: 16 mi N El Paso, 10 (UI); 15 mi N El Paso, 21 (UI); 15 mi N El Paso, 5 mi SE junction I-10 and HWG 404, 4 (UI); Hidalgo Co.: Dog Springs, 1 (USNM). COAHUILA. 15 mi S, 25 mi E Bouquillas, 7300 ft, 3 (NTSU); Sierra del Carmen, Campo Madera, 8000 ft, 10 (9 USNM, 1 DMNH); Sierra del Carmen, Oso Cañon, 3 (DMNH); Sierra del Carmen, Botellas Cañon, 1 (DMNH).

For all other specimens of *P. difficilis*, examined by me, the taxonomy followed is that given by Hoffmeister and de la Torre (1961).

Peromyscus difficilis griseus Benson

Specimens examined: Total 185. NEW MEXICO. Lincoln Co.: 6½ mi W, 5 mi N Carrizozo, 9 (UI); 5 mi W, 5 mi N Carrizozo, 21 (UI); 5 mi N, 4.75 mi W Carrizozo, 25 (UI); 4¼ mi N, 3½ mi W Carrizozo, 25 (UI); 3 mi N, 2.75 mi W Carrizozo, 70 (UI); 3 mi W Carrizozo, 2 (UI); 3½ mi W, 2 mi N Carrizozo, 33 (UI).

Peromyscus difficilis nasutus (J. A. Allen)

Specimens examined: Total 259. NEW MEXICO. Sierra Co.: San Andres Mtns., N slope Salinas Peak, 6000 ft, 4 (USNM); San Andres Mtns., Bear Canyon, 2 (USNM); San Andres Mtns., N slope Salinas Peak, 5000 ft, 3 (USNM). Lincoln Co.; Capitan Mountains, 24 (USNM); Corona, 1 (USNM); Jicarilla Mountains, 15 (USNM). Otero Co.: ½ mi W High Rolls, 13 (6 UI, 7 JD); 12 mi E Alamogordo, 1 (JD); Sacramento Mtns., 1 mi W High Rolls, 2 (UTEP); Russian Canyon, Sacramento Mtns., 5 mi S, 2½ mi E Clouderoft, 1 (UTEP); Doña Ana Co.: 35 mi NE Las Cruces, San Andres Canyon, San Andres Mtns., 5600 ft, in tunnel of lead mine, 1 (USNM). Eddy Co.: Slaughter Canyon, 4.75 mi S, 11 mi W White City, 1 (UI); 26 mi W, 10 mi S Carlsbad, 1 (ENMU). ARIZONA. Apache Co.: Springerville, 2 (USNM); 4 mi E Springerville, 60 (UI); 4½ mi ESE Springerville, 44 (UI); 3 mi SE Springerville, 11 (USNM); 4½ mi SSE Springerville, 33 (UI). Cochise Co.: 1¼ mi E Fly's Peak, Greenhouse Canyon, Chiricahua Mtns., 7500 ft, 15 (UI); Fly's Peak, Chiricahua Mtns., 10 (UI); ½ mi E Buena Vista Peak, Chiricahua Mtns., 8100 ft, 2 (UI); 7 mi W Portal, 1 (JD); 1 mi NW Research Station, Chiricahua Mtns., 1 (UI); 1 mi SW Portal, 7 (UI); 1 mi up Cave Creek from Portal, 1 (UI). TEXAS. Culberson Co.: McKittrick Canyon, 7800 ft, 1 (USNM); 2 mi E Pine Springs, 2 (UI).

Peromyscus difficilis difficilis (J. A. Allen)

Specimens examined: Total 42 from: CHIHUAHUA. 15 mi S, 6 mi E Creel, 7300 ft, 24 (KU); Divisadero, 16 mi S, 13 mi W Creel, 7500 ft, 14 (KU); N rim Barranca del Cobre, 23 mi S, 1½ mi E Creel, 7200 ft, 3 (KU); Churo, 7200 ft, 1 (KU).

Peromyscus difficilis petricola Hoffmeister and de la Torre

Specimens examined: Total 66 from: COAHUILA. Sierra Encarnacion, 19 (USNM); Carneros, 2 (USNM); Sierra Guadalupe, 25 (USNM); 8 mi S Bella Union, HWY 57, 6 (UI). NUEVO LEON. Along road 1 mi NE microwave tower, E slope Cerra Potosi, 1 (USNM); .75 mi NE microwave tower, E slope Cerra Potosi, 1 (USNM); Rocks along road NE microwave tower, 9850 ft, E slope Cerra Potosi, 1 (USNM); Rock ledge, Cerra Potosi, 1 (USNM). ZACATECAS. 4 mi W Concepcion del Oro, 10 (UI).

Conclusions

Peromyscus difficilis from the Franklin Mountains of Texas and New Mexico and from northern Coahuila are referable to a distinct subspecies for which the name *Peromyscus boylii penicillatus* Mearns, 1896, is available. Analyses of various cranial, external, and chromosomal characters are presented to facilitate recognition of *P. difficilis penicillatus* from closely related species of *Peromyscus*. Methods are

discussed for differentiating *P. difficilis penicillatus* from geographically peripheral subspecies of *P. difficilis*: *P. d. griseus*, *P. d. difficilis*, *P. d. nasutus*, and *P. d. petricola*. The habitat preference of *P. difficilis* is described.

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